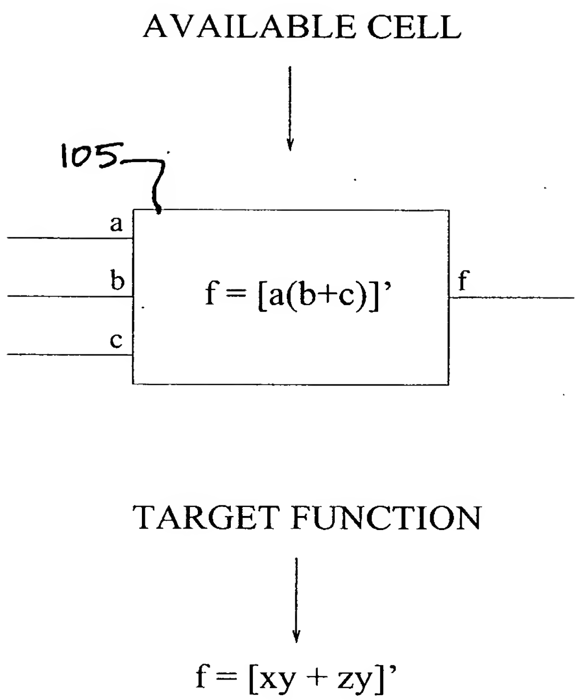


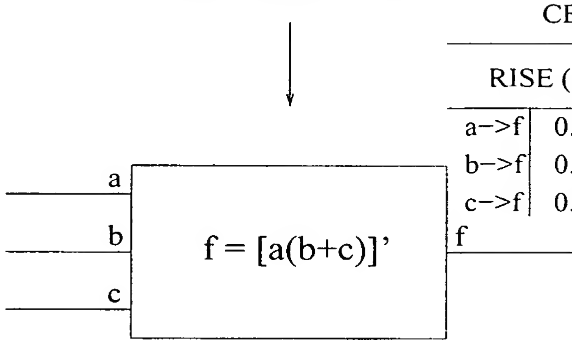
FIG. 1

FUNCTIONAL MATCHES

MATCH_1		MATCH_2	
a	y	a	y
b	x	b	z
c	z	c	x

FIG. 1a

AVAILABLE CELL



CELL TIMING

RISE (ns)		FALL (ns)	
a->f	0.09	a->f	0.06
b->f	0.15	b->f	0.12
c->f	0.20	c->f	0.13

TARGET FUNCTION

f = [xy + zy]'

220

TIMING REQUIREMENT

RISE (ns)		FALL (ns)	
z->f	0.15	z->f	0.12

FIG. 2

205 210

FUNCTIONAL MATCHES

MATCH_1		MATCH_2	
a	y	a	y
b	x	b	z
c	z	c	x

TIMING REQUIREMENT

215

(FUNC + TIME) MATCH

MATCH	
a	y
b	z
c	x

FIG. 2a

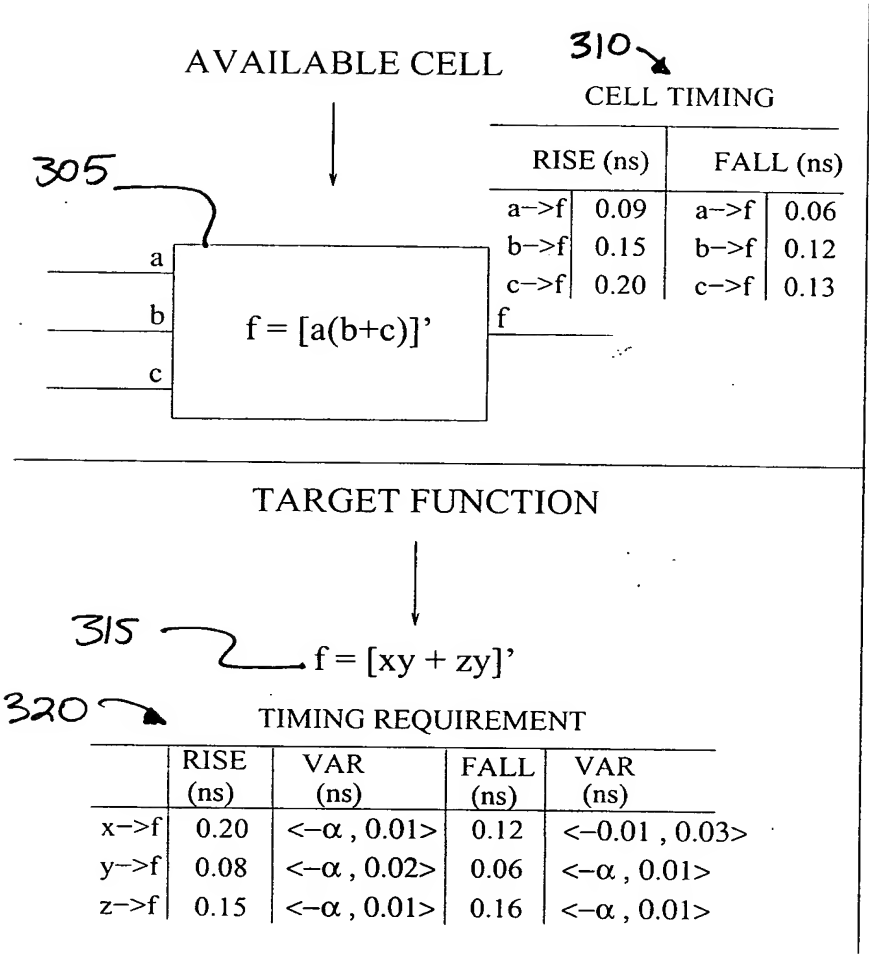

AVAILABLE CELL
310
CELL TIMING
305
a
b
c
f = [a(b+c)]'
f
RISE (ns)
FALL (ns)
a->f 0.09
b->f 0.15
c->f 0.20
a->f 0.06
b->f 0.12
c->f 0.13
TARGET FUNCTION
315
f = [xy + zy]'
320
TIMING REQUIREMENT
RISE (ns)
VAR (ns)
FALL (ns)
VAR (ns)
x->f 0.20 <-α , 0.01> 0.12 <-0.01 , 0.03>
y->f 0.08 <-α , 0.02> 0.06 <-α , 0.01>
z->f 0.15 <-α , 0.01> 0.16 <-α , 0.01>

FIG. 3

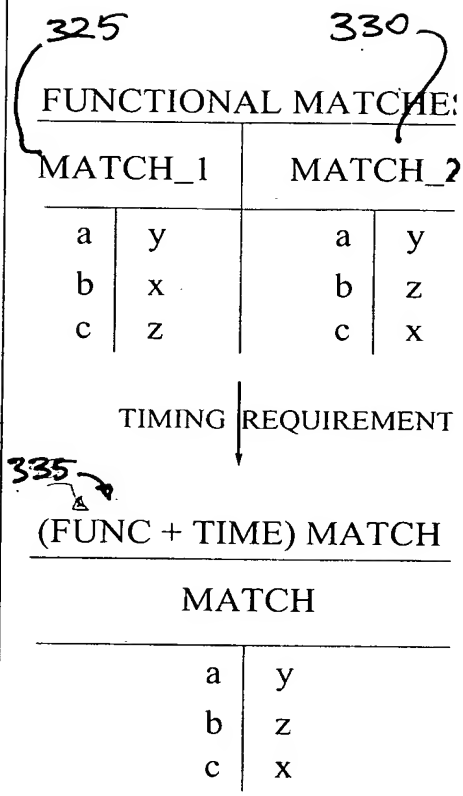

325
330
FUNCTIONAL MATCHES
MATCH_1
MATCH_2
a y
b x
c z
a y
b z
c x
TIMING REQUIREMENT
335
(FUNC + TIME) MATCH
MATCH
a y
b z
c x

FIG. 3a

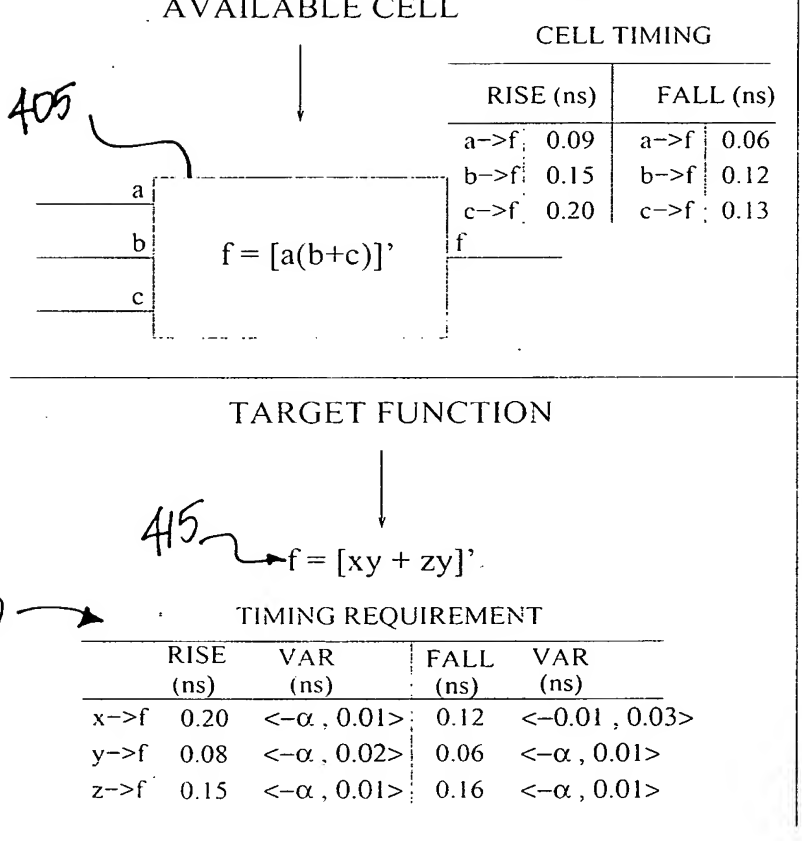


FIG. 4

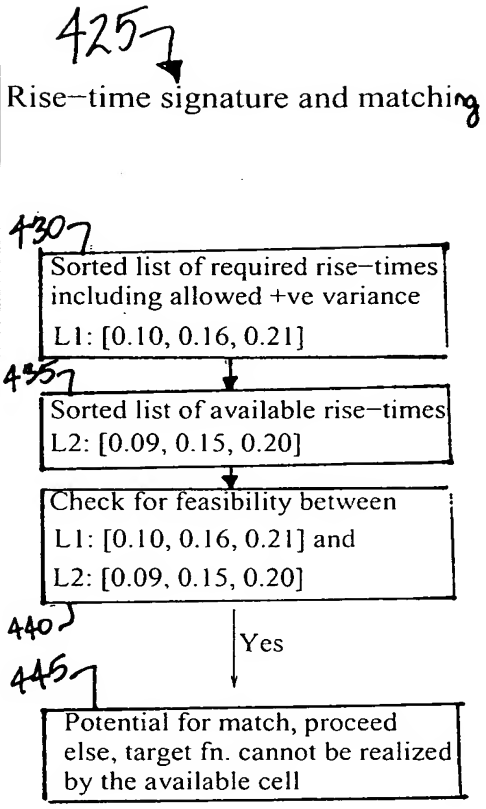


FIG. 4a

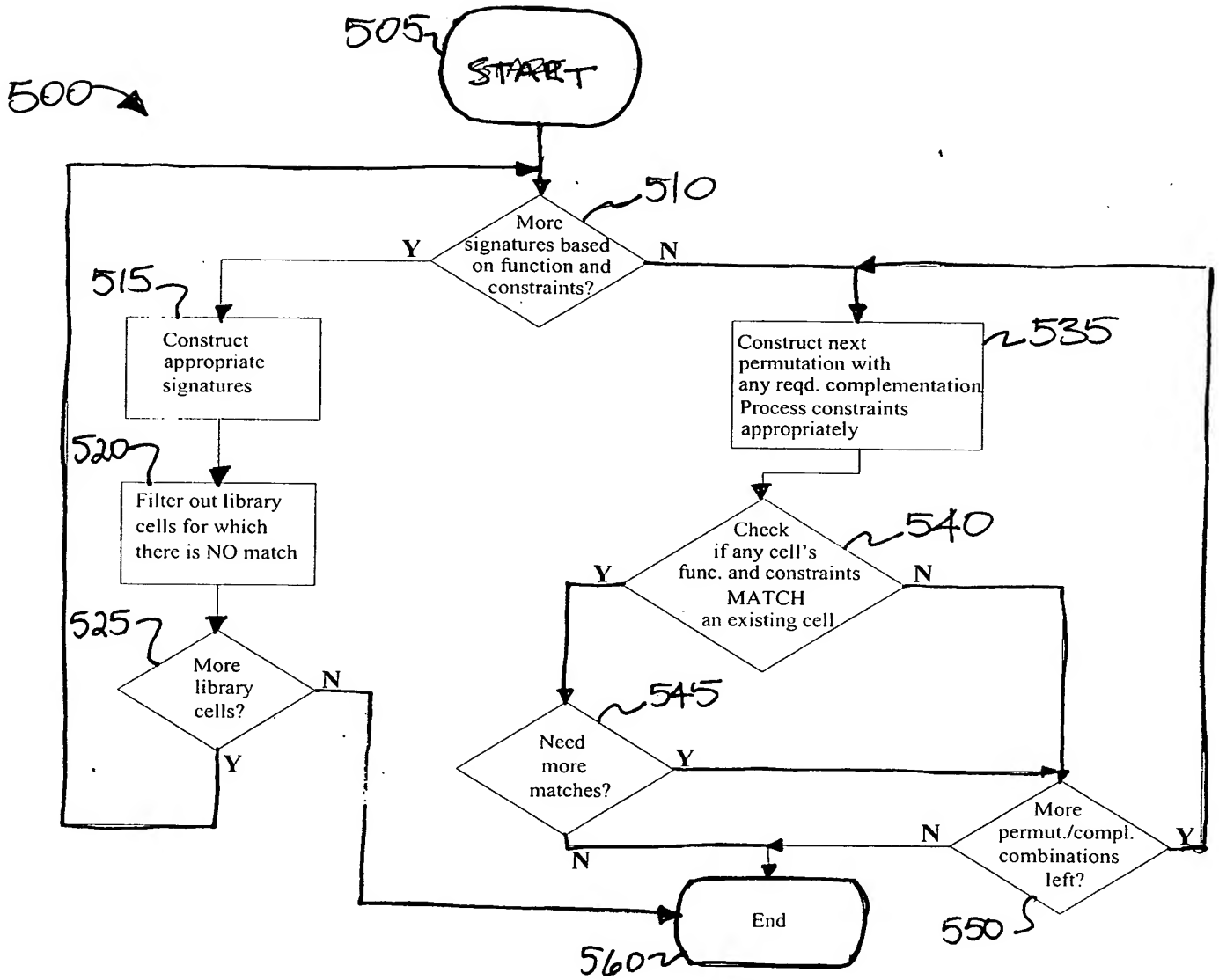
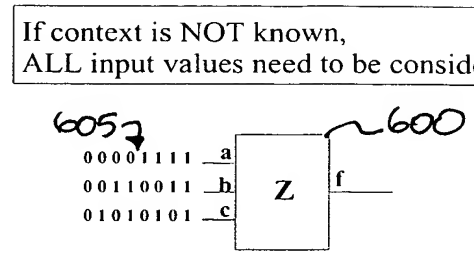

500
505
START
510
More signatures based on function and constraints?
Y
N
515
Construct appropriate signatures
520
Filter out library cells for which there is NO match
525
More library cells?
N
Y
535
Construct next permutation with any reqd. complementation Process constraints appropriately
540
Check if any cell's func. and constraints MATCH an existing cell
Y
N
545
Need more matches?
Y
N
More permut./compl. combinations left?
N
Y
550
End
560

FIG. 5



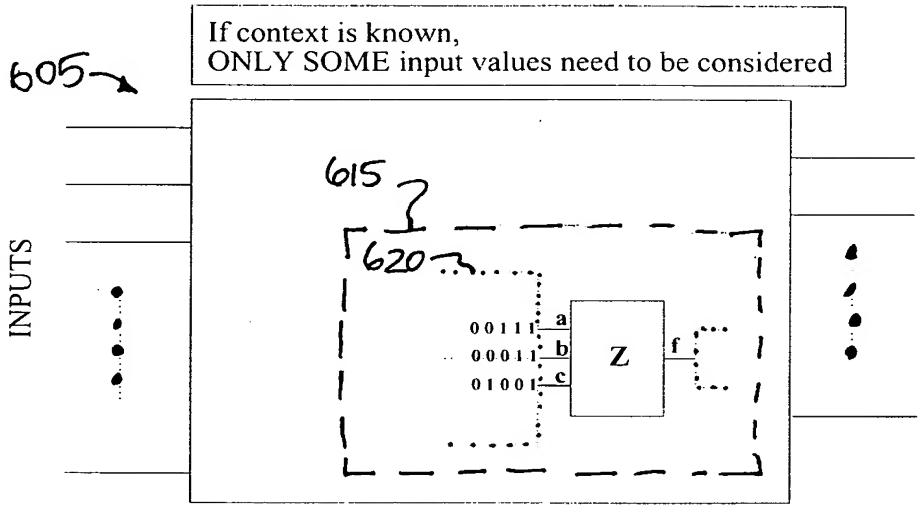
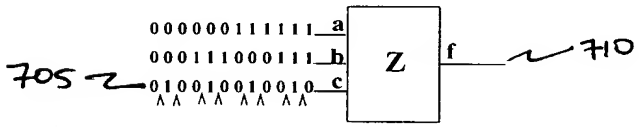


FIG. 6

If context is NOT known,
To characterize timing on c->f
ALL possible 0->1 and 1->0 transitions
on C need to be considered



If context is known,
To characterize timing on c->f
ONLY SOME 0->1 and 1->0 transitions
on C need to be considered
(Context eliminates other transitions)

- Characterization is MORE accurate
- Characterization needs LESSER resources

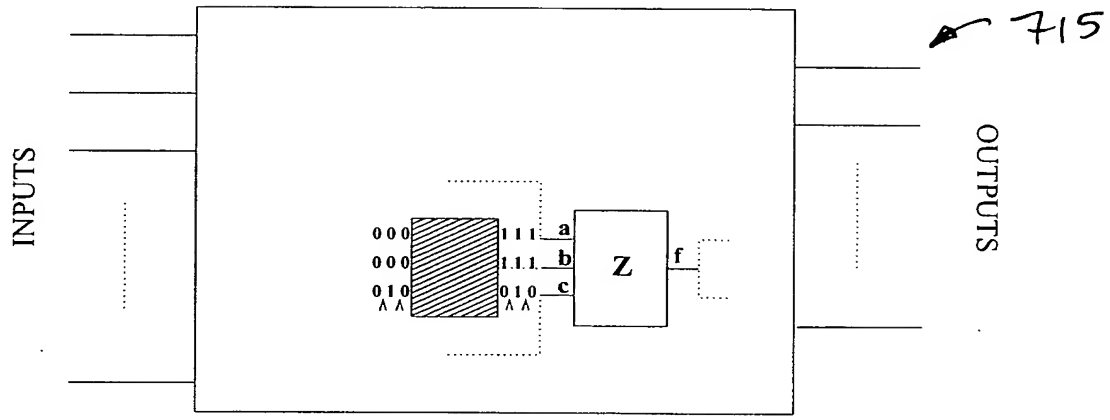
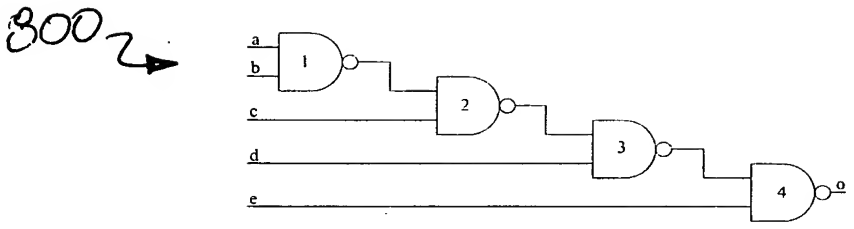


FIG. 7



805

Worst propagation delay through the design

Drive strengths at stage	Gate-level timing (STA)	Transistor-level timing (SPICE)
1 2 3 4	(ns)	(ns)
0 0 0 0	0.40	0.186
1 1 1 1	0.22	0.166
2 2 2 2	0.15	0.157
4 4 4 4	0.61	0.581
0 1 2 4	0.41	0.332

Figure 8: Example to illustrate that characterization at the transistor-level is more accurate than that done by gate-level static timing analysis

FIG. 8

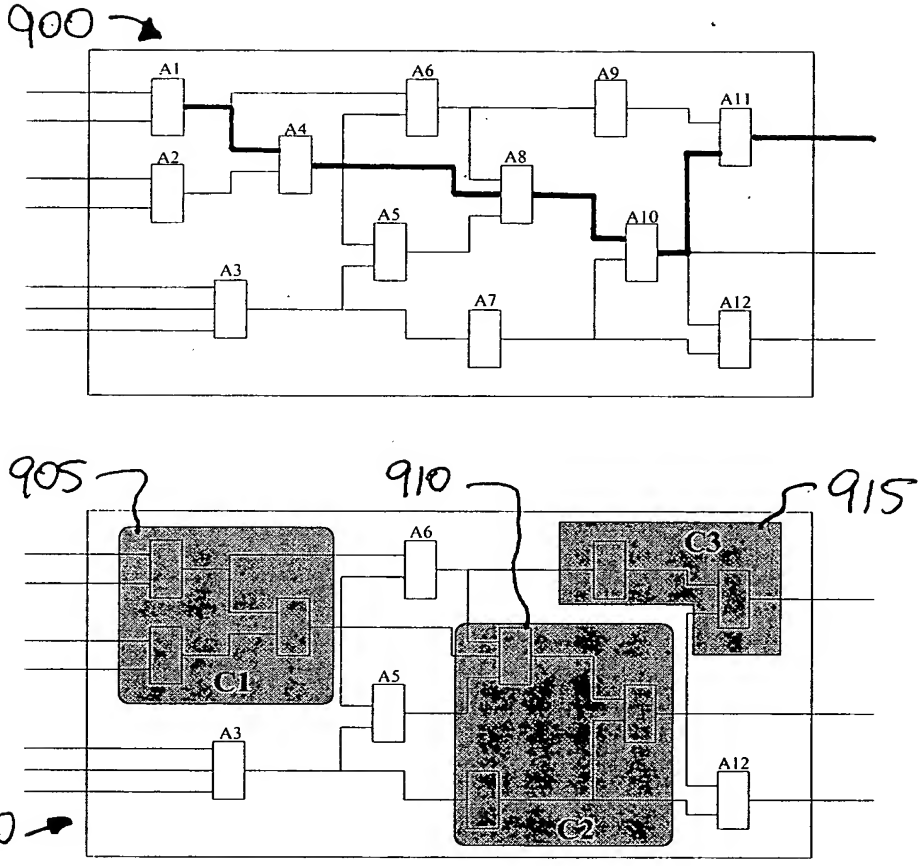


FIG. 9